

CS341 Automata Theory (Fall 2003)

Homework Assignment #5

Due Date: Monday, November 24, 2003 (at the beginning of class)

Do not forget to write your name, identification number and class time at the top of the first page of your solution set. No collaboration is allowed; all solutions submitted must be your own work.

1. Construct Turing machines that recognize the following languages. The first two TMs must be defined formally.
 - (a) $L = aba^*b$
 - (b) $L = \{ww^R \mid w \in \{a, b\}^*\}$
 - (c) $L = \{a^n b^n a^n b^n \mid n \geq 0\}$
 - (d) $L = \{a^n b^{n+m} c^m d^n \mid m, n \geq 0\}$
 - (e) $L = \{x\#w \mid x, w \in \{a, b\}^* \text{ and } x \text{ is a substring of } w\}$
2.
 - (a) Construct a Turing machine that computes the function $f : \mathbb{N}^2 \rightarrow \mathbb{N}$ where $f(n_1, n_2) = \max(n_1, n_2)$. You must define the TM formally.
 - (b) Construct a TM that computes the function $f(n) = 3n + 5$. You must define the TM formally.
3. Prove that the recursive languages are closed under
 - (a) union
 - (b) concatenation
 - (c) kleene star
4. Prove that the recursively enumerable languages are closed under
 - (a) union
 - (b) concatenation
 - (c) kleene star
5. Sipser exercise 3.11
6. Sipser exercise 3.19